1. RFID Tutorial: requirements and resources

Gabrielle Davidson - School of Biological Sciences, University of East Anglia

2024-08-08

Welcome to The RFID Tutorials - a set of R scripts with example data to get you started with performing ecological research with wild birds using autonomous data collection methods. Here you will learn the basics of manipulating and preparing data collected from RFID computerised feeders that will later be used for statistical testing (not covered here).

1.1 Installations

Downlaod the latest version of **R (https://cran.r-project.org/bin/)** and **R Studio (https://posit.co/download/rstudio-desktop/)** according to your operating system. Be sure to install R before installing R studio.

```
#Open Rstudio and install the following packages
install.packages("tidyverse")
install.packages("rmarkdown")
install.packages("dplyr")
install.packages("tidyr")
install.package("tidyverse")
install.packages("lubridate")
install.packages("ggplot2")
install.packages("stringi")
install.packages("magrittr")
#for tutorial 5
install.packages("writexl")
install.packages("readxl")
install.packages("zoo")
```

If you receive errors, search them on google or ask chatgpt. Sometimes the error message will specify a package that could not be installed or is out of date. Attempt to install missing packages before installing the package(s) above. Make sure your R version is up to date and that it was installed prior to installing/updating r studio

1.2 Check R packages installed by loading them

```
#load the above packages to check they installed properly
library(tidyverse)
library(rmarkdown)
library(dplyr)
library(tidyr)
library(tidyverse)
library(lubridate)
library(ggplot2)
library(stringi)
library(magrittr)
```

1.3 Download raw datasets necessary for the tutorial and save them in a workspace folder

Download the resources from **my github page (https://github.com/DrGLDavidson/RFID-workshop)**

Create and name a workspace. This is a folder on your computer that tells R where to obtain files.

1.4 Download useful R cheat sheets

R Markdown Cheat Sheet (https://www.rstudio.com/wp-content/uploads/2015/02/rmarkdown-cheatsheet.pdf)

dplyr Cheat Sheet (https://gauss.inf.um.es/tabular/www/data-transformation.pdf)

dplyr and tidyr Cheat Sheet (https://www.rstudio.com/wp-content/uploads/2015/02/data-wrangling-cheatsheet.pdf)

lubridate Cheat Sheet (https://rawgit.com/rstudio/cheatsheets/main/lubridate.pdf)

1.5 Useful literature

Davidson papers using RFID to measure behaviour in wild great tits and blue tits at feeders and nestboxes:

Multiple factors affect discrimination learning performance, but not between-individual variation, in wild mixed-species flocks of birds (https://doi.org/10.1098/rsos.192107)

Episodic-like memory in wild free-living blue tits and great tits (https://doi.org/10.1016/j.cub.2024.06.029)

Inhibitory control performance is repeatable over time and across contexts in a wild bird population (https://doi.org/10.1016/j.anbehav.2022.02.007)

Other groups using RFID to measure behaviour in alternative ways:

Inferring dominance interactions from automatically recorded temporal data (https://doi.org/10.1111/eth.12720)

Individual variation in spatial memory performance in wild mountain chickadees from different elevations (https://doi.org/10.1016/j.anbehav.2015.10.015)

Spatial, temporal and individual-based differences in nest-site visits and subsequent reproductive success in wild great tits (https://doi.org/10.1111/jav.01740)

General autonomous data collection methodology and approaches:

Broad-scale applications of the Raspberry Pi: A review and guide for biologists (https://doi.org/10.1111/2041-210X.13652)

The OpenFeeder: A flexible automated RFID feeder to measure interspecies and intraspecies differences in cognitive and behavioural performance in wild birds (https://doi.org/10.1111/2041-210X.13931)

An Arduino-Based RFID Platform for Animal Research (https://doi.org/10.3389/fevo.2019.00257)

Shazam for bats: Internet of Things for continuous real-time biodiversity monitoring (https://doi.org/10.1049/smc2.12016)

Shazam for bats: Internet of Things for continuous real-time biodiversity monitoring (https://doi.org/10.1049/smc2.12016)